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The capacities of institutions for the integration of ecosystem services in coastal strategic planning: The case of Jiaozhou Bay

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ABSTRACT

This paper explains how the practice of integrating ecosystem-service thinking (i.e., ecological benefits for human beings) and institutions (i.e., organisations, policy rules) is essential for coastal spatial planning. Adopting an integrated perspective on ecosystem services (ESs) both helps understand a wide range of possible services and, at the same time, attune institution to local resource patterns. The objective of this paper is to identify the extent to which ESs are integrated in a specific coastal strategic planning case. A subsequent objective is to understand whether institutions are capable of managing ESs in terms of uncovering institutional strengths and weaknesses that may exist in taking ESs into account in existing institutional practices. These two questions are addressed through the application of a content analysis method and a multi-level analysis framework on formal institutions. Jiaozhou Bay in China is used as an illustrative case. The results show that some ESs have been implicitly acknowledged, but by no means the whole range. This partial ES implementation could result from any of four institutional weaknesses in the strategic plans of Jiaozhou Bay, namely a dominant market oriented interest, fragmented institutional structures for managing ESs, limited ES assessment, and a lack of integrated reflection of the social value of ESs in decision-making. Finally, generalizations of multi-level institutional settings on ES integration, such as an inter-organisational fragmentation and a limited use of ES assessment in operation, are made together with other international case studies. Meanwhile, the comparison highlights the influences of extensive market-oriented incentives and governments' exclusive responsibilities on ES governance in the Chinese context.

1. Introduction

Recently, the concept of Ecosystem Services (ESs) has become a major issue in environmental planning and management at all decision-making levels (De Groot et al., 2010). It is broadly described as the 'contributions of ecosystems to human well-being' (De Groot et al., 2010). ESs capture the interdependent relationships between human wellbeing and the services that ecosystems supply. By making ESs explicit – that is, by identifying and assessing ESs and their relationships at various temporal and spatial scales – it is possible to provide an evaluation of various decisions about the future supply of the whole range of ESs (Hancock, 2010).

Until now, scholars in this field have increasingly focused on analysing institutions for integrating ESs in policies and plans. Institutions, incentives and regulatory mechanisms affect the use of ESs and can be effective in preserving and managing the supply of ESs, thus contributing to the long-term sustainability of management decisions (Hancock, 2010). Institutions are 'enduring regularities of human action in situations structured by rules, norms, and shared strategies, as well as by the physical world' (Crawford and Ostrom, 1995). Consequently, institutional design refers to devising and realizing rules, procedures and organisational structures to enable and constrain behaviour and action so as to preserve values, achieve desired objectives or execute certain tasks (Alexander, 2006).

There are two main objectives of the research that focus on analysing institutions for integrating ESs. The first objective has been to assess or support policy and decision making with regards to ESs through, for instance, the economic valuation of ESs, social value assessment, trade-off analysis, and mapping and modelling.

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Most of these ES approaches have been increasingly used for improving coastal institutions (e.g. Kumar, 2010; Barbier et al., 2011; Pike et al., 2011; Haines-Young et al., 2012; Onaindia et al., 2013; Lopes and Videira, 2013). The second objective has been to examine and understand how specific institutions are related to certain ESs. For example, Namaalwa et at. (2013) analysed the institutional context for management of Namatala wetland to examine drivers of ES changes. Primmer and Furman (2012) reviewed three operational governance settings, i.e. consecration of forest biodiversity, urban land use planning and natural resource strategies, finding mismatch between governance needs and ES approaches. Historical analysis of urban strategic plans in Melbourne and Stockholm was conducted by Wilkinson et al. (2013), revealing a variable and inconsistent attention to urban ES over time. EU policies in the fields of agriculture, forestry, environmental policy, water and regional development were also assessed, uncovering that many ESs were often negatively affected by policies (Hauck et al., 2013). With regards to coastal ESs, the existing studies mainly focus on more comprehensive institutional analyses on, for instance, integrated coastal zone management (ICZM) or ecosystem-based management (EBM) (e.g. Cao and Wong, 2007; Carollo and Reed, 2010; Katsanevakis et al., 2011; Deboudt, 2012; Wu et al., 2012; Cárcamo et al., 2013; Valman, 2013). Only occasionally do these studies identify and assess coastal ESs clearly. Besides, only a few studies have attempted to examine what and how coastal ESs may be included in planning and management, for instance, analyses of Polish coastal municipal strategic plans (Piwowarczyk et al., 2013), English coastal wetlands management (Holt et al., 2011) and financial mechanism design for ESs in coastal and marine settings (Lau, 2013). Nevertheless, they tend either to illustrate an identification of some certain coastal ESs, or these studies are only limited to partial institutional restrictions on ES implementation, rather than assuming a broader institutional design context.

Therefore, the objective of this paper is to identify the extent to which a range of coastal ESs are integrated in coastal strategic planning, and to detect what institutional strengths and weaknesses there could be for ESs use according to a multi-level framework for institutional design analysis as developed by Alexander (2005, 2012). Our purpose is primarily to improve our grounded knowledge of the current institutional capacity of facilitating ES governance, which can been seen as an initial and essential step for designing institutions, not to stress how to develop institutions for identified causal effects by a complete assessment of formal institutional design. This Alexander's framework facilitates a comprehensive analysis of rules, process and organisational structures, which could be important implications for ES governance. Within this broad institutional framework, this study focuses on one particular institution, namely coastal strategic planning. Strategic planning is distinguished by its typical characteristics and its position within the institutional network, e.g., the focus on longer-term goals, the importance of contextual reflection and its comprehensive guiding function for sectoral plans and organisations. These factors imply that strategic planning is unable to ignore the essential planning function of natural resources and ecosystem services, which are suffering from both natural and anthropogenic pressures. Strategic planning could require the inclusion of an ES perspective to make motivating the institutional framework more sustainable.

The central argument of this paper is that it is essential to integrate perspectives from both ecosystem-service thinking and institutions for effective coastal strategic planning. Identifying ESs clearly in coastal strategic planning could remind planners and decision-makers of the significance of the whole range of possible services, including those previously ignored. In turn, clarifying institutional strengths and weaknesses could provide potential opportunities for evolving institutions to be more effective in implementing ES concept and methods.

The structure of this paper is as follows. First, we introduce the central case and the related coastal strategic plans. This paper uses Jiaozhou Bay in China as an example. There are two main considerations underpinning this case selection. One is the long-term role played by this bay in providing rich ESs to urban/regional planning and development (Zhao et al., 2005; Ge and Zhang, 2011), which implies a potential advantage when identifying multiple ESs in strategic planning. The other consideration is that the case has relatively comprehensive institutional arrangements in place (Li, 2006; Wu et al., 2012), which facilitates its role as an illustrative case, and potentially offers generic insight into the policy implementation for different ESs. Following that, we explain the two methods adopted to operationalize the two perspectives of ecosystem-service thinking and institutions. First, a content analysis method was applied to identify the extent to which ESs are integrated in the coastal strategic plans for Jiaozhou Bay. Second, the multi-level framework of institutional design analysis as developed by Alexander (2005, 2012) was employed to analyse the three levels (the macro, meso and micro) of institutions for the strategic plans concerning to Jiaozhou Bay. After explaining the results, we discuss the capacity of existing formal institutions to manage ESs in Jiaozhou Bay. Finally, we provide general institutional implications for ES governance from this research together with other international case studies.

2. Methods

2.1. Study area

Jiaozhou Bay is a semi-enclosed shallow-water body situated on the southern coast of the Shandong Peninsula in East China (Fig. 1), surrounded by Qingdao City (7 districts and 5 county-level cities along the Bay with a population of 8.71 million) in Shandong province. In 2012, the Bay covered an area of 343.5 km^2 and had 206.8 km of coastline. Jiaozhou Bay is a typical case in China, as it strongly supports urban development through a wide variety of ESs (e.g. tourism, fisheries, transportation and agriculture: Zhao et al., 2005). Meanwhile, its ecosystem has been altered by climate change, storm surges, seaweed blooms, flooding and various anthropogenic pressures, in particular as a consequence of land reclamation, causing irreversible damage to some ESs (Ge and Zhang, 2011). In this area, strategic planning involves an essential institutional effort to address these problems with regards to managing behaviours or actions of organisations, agencies, groups and individuals in certain geographical areas. The municipal government, provincial government and some national ministries take the main responsibility for developing strategic plans (see Table 1). A particular sector is assigned as a coordinating body to implement planning process. Other government sectors whose authorities may be related to any coastal issue (e.g. the Forestry Bureau, Ocean and Fisheries Bureau and Environmental Bureau) will be typically involved in consultation and final agreement in terms of meetings or official letters. An expert advisory committee is established to provide professional support for assessing feasibility and impact. After the plan draft is formed, it is submitted for public comment. Finally, the State Council, provisional or municipal government have the right of approval for these plans.

We selected four strategic spatial plans for Jiaozhou Bay. All four of these plans were formulated in the last five years (see Table 1). We collected them in March 2013 from official websites and from the responsible authorities. The *'Conservation and Development around Jiaozhou Bay' Strategy of Qingdao* (Plan 1) aims to create an

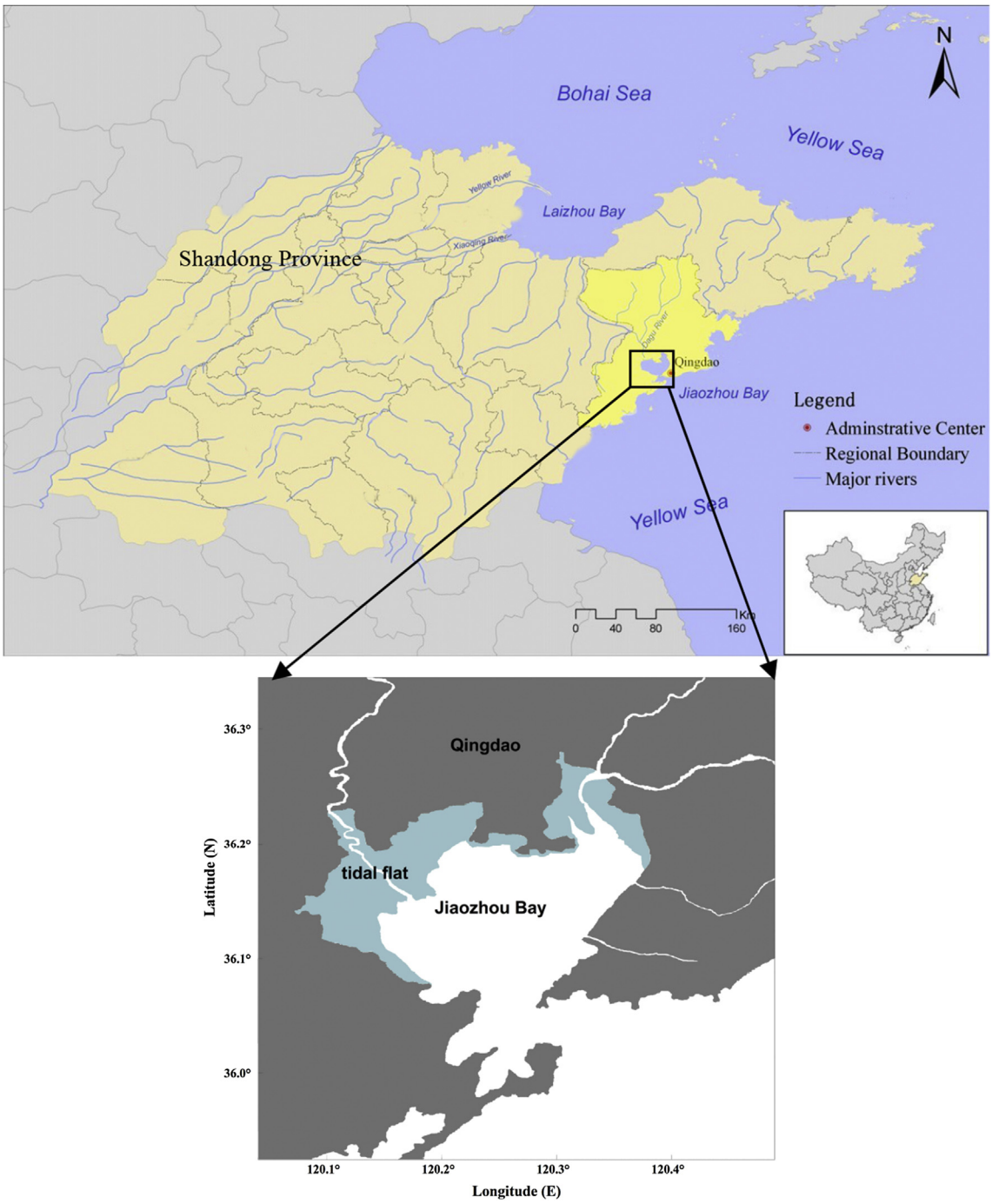

Fig. 1. Jiaozhou Bay, Qingdao and Shandong Province.
(Source: The map of Shandong province was adopted from Wu et al. (2012).

ecological and garden-like metropolitan area around the Bay. It is an important urban space development strategy which integrates ecological protection and industrial development. Based on this plan, Qingdao was adopted in a national sustainable development strategy – *The Development Plan of Shandong Peninsula Blue Economic Zone* (Plan 2). This plan is the first regional development strategy with a marine economy theme in China. Optimizing the landscape of land and sea, establishing a modern marine industrial system and strengthening the marine ecological civilization within Shandong Peninsula are a few examples of where coastal resources are benefited from. Furthermore, policymakers and planners from Qingdao have also tended to emphasise the critical role of Jiaozhou Bay in supporting the municipal economy and guaranteeing citizens' wellbeing. Consequently, two statutory urban strategic plans, *The Twelfth Five-year National Economic and Social Development Plans of Qingdao* (Plan 3) and *The Overall Urban Plan of Qingdao (2011–2020)* (Plan 4), are used to reflect this perspective.

Together, these four strategic plans present the close ties between regional/local development and the coastal ESs of Jiaozhou Bay. They also represent the powerful influence that coastal institutional networks have over whether the ES concept will be considered. Moreover, to gain a broader view of institutional

Table 1
Summary of four strategic plans related to Jiaozhou Bay.

No.	Document	Year	Planning scope	Planning scale	Description	Sponsoring organisation	Implementing organisation
Plan 1	'Conservation and Development Around Jiaozhou Bay' Strategy of Qingdao	2008	South-western region of Qingdao and parts of some districts along the Bay. Total area: ~500 km^2	Local	A new urban space development strategy, integrating regional ecological protection and industrial economic development, forming a model for blue economic development.	Qingdao Municipal Government	Qingdao Urban Planning Bureau
Plan 2	The Development Plan of Shandong Peninsula Blue Economic Zone	2011	All provincial waters, six cites including Qingdao, and other two coastal counties. Sea area: ~159,500 km^2 Land area: 64,000 km^2	Regional	The first regional development strategy with a marine economy theme in China, coordinating terrestrial and marine economy, culture, society and ecology.	National Development and Reform Commission, the People's Government of Shandong Province	Shandong Province Development & Reform Commission
Plan 3	The Twelfth Five-year National Economic and Social Development Plans of Qingdao	2011	N/A	Local	Governs and guides other thematic and sectoral plans (economy, people's livelihoods, social, cultural and institutional reforms)	Qingdao Municipal Government	Qingdao Development & Reform Commission
Plan 4	The Overall Urban Plan of Qingdao (2011–2020)	2012	Urban scope: six districts and four towns belonging to Qingdao administrative area. Land area: 11,282 km^2 Sea area: 12,200 km^2	Local	Implements the comprehensive national blue economic development strategy, optimizes and enhance city functions, size, the urban planning area and transport plan.	Qingdao Municipal Government	Qingdao Urban Planning Bureau

Source: Plans 1 and 4 were retrieved from the Qingdao Urban Planning Bureau (QUPB) website (http://upb.qingdao.gov.cn) and its records office (only paper documents), respectively; Plan 2 came from the Shandong Peninsula Blue Economic Zone Construction Office website (http://www.sdlb.gov.cn); and Plan 3 was from the Qingdao Development & Reform Commission website (http://www.qddpc.gov.cn/qddpc/).

context and insights into the practice of these strategic plans, we also investigated a number of policies, legislations, regulations, and government reports pertaining to this bay and the four plans. These formal institutions, remaining dominant in this area, are critical for affecting and structuring ES utilization, which have been strikingly demonstrated through the strategic plans. In particular, institutions with a direct interest in or control over natural resources (e.g. wetlands habitat conservation), markets (e.g. aquaculture and oil) or nonmarket values of affected populations (e.g. recreation and education) are involved in these four plans, thereby stimulating, permitting, limiting and prohibiting certain activities of using coastal ESs. Rewards and sanctions (e.g. tax preferences for overseas fishery and marine energy, a sea use fee, and an ecological compensation fee) related to coastal actions are also addressed in these strategic plans. These documents provide available and valuable information on ES governance. We therefore assumed that analysis on formal institutions, particularly these strategic plans, could serve as a way to inform a study of how ESs are included, what existing institutional practices seem helpful or harmful for promoting ES integration.

2.2. Content analysis

To identify the extent to which ESs are integrated into the coastal strategic plans for Jiaozhou Bay, a content analysis method accompanied by text interpretation was employed. This method enabled us to identify what coastal ESs are available and to what extent they were included in the strategic planning efforts for Jiaozhou Bay. Content analysis permits identification of key coastal ecosystem characteristics and the context in which ES information should be identified. The analysis is based on an interpretation of narratives related to coastal goods and services as they emerge from the strategic plans.

A coding system is essential to grouping and analysing texts relevant to ESs. First, to establish a coding system, we applied the standard ESs classification system published by the Millennium Ecosystem Assessment (MA, 2005). It contains four categories: provisioning (products obtained from ecosystems), regulating (benefits obtained from regulation of ecosystem process), cultural (providing opportunities for non-material benefits and cognitive development) and supporting services (services that are necessary for the proper delivery of the above three ES groups). Given the particular services provided by coastal ecosystems based on the above four main categories, a detailed classification (Table 2) was prepared based on previous research prior to the examination of these plans. This classification exercise provided a wide range of coastal and marine ES concepts and examples (e.g. Beaumont et al., 2007; Rönnbäck et al., 2007; Österblom et al., 2010; Atkins et al., 2011). The meaning of these concepts for coastal ESs is based on definitions and examples according to the scientific literature collected. The overall classification includes criteria for interpreting and validating data. The classification also served as a coding system to facilitate the consistency of the document analyses overall.

Subsequently, the four selected coastal strategic plans were opened one by one and examined sentence by sentence to identify each coastal ES listed in Table 2. Manuscript extraction techniques for paper documents and NVivo software for electronic documents were used to code terms and phrases within the documents. If a

Table 2
Coastal ecosystem services related to coastal spatial planning.

Category	ES and examples
Provisioning	Fish & seafood
	Energy production (biomass fuel, offshore oil and gas, wind, tide and wave power)
	Biochemical and pharmaceutical uses
	Transport and navigation (use of waterways for shipping)
	Coastal space for industrial development and infrastructure
	Residential and industrial water supply (abstraction of water for residential and industrial purposes)
Regulating	Prevention of floods, storms, tsunamis and typhoons (protection by biogenic structures)
	Seawater intrusion
	Algal blooms
	Erosion and siltation control (maintenance of productive sediments, mitigating the effects of sea-level rise)
	Water purification and waste treatment
	Climate regulation (balance and maintenance of the atmosphere)
Cultural	Tourism and recreation (beach tourism, sunbathing, diving, wind and kite-surfing, fishing, spas and wellness, and bird-watching)
	Cognitive values (education and research resulting from the marine environment, school excursions, monitoring of global environmental change and indicators of ecosystem health, and long-term environmental records)
	Aesthetic beauty (landscape)
	Cultural heritage and identity (value associated with the marine environment itself)
Supporting	Maintenance of biodiversity
	Maintenance of habitats
	Resilience of ecosystems (ability to cope with natural and anthropogenic change)
	Soil formation

Source: (MA, 2005, Beaumont et al., 2007, Rönnbäck et al., 2007, Österblom et al., 2010, Atkins et al., 2011).

type of ES was referred to in a way that is linking to the meaning of an ES concept or containing any examples in the coding system (Table 2), it was marked and counted. Accordingly, key references could be summed up in a table. Meanwhile, the frequency of the interpreted and marked ESs would be calculated in another table. This table with the references stated above enabled a clear understanding of differing extents to which each ES was integrated. Finally, two rounds of document checking were performed before we summarized and drew a figure to show total frequencies in terms of four ES categories in the Jiaozhou Bay coastal strategic documents.

2.3. A multi-level analysis framework

For our purpose of understanding how the existing formal institutions are capable of managing the four categories of ESs as an initial step towards institutional design, we adopted the multi-level framework of institutional design as developed by Alexander (2005, 2012) to guide our analysis, thereby explaining results (i.e. different degrees to which each ES is included in the content analysis of strategic planning documents). Alexander (2005, 2012) clarified that there are three 'levels' associated with institutional design: constitution writing (the macro-level), inter-organisational coordination (the meso-level) and intra-organisational institution (the micro-level). Each level has different emphases on intuitions. At the highest level, significant macro-societal processes and institutions that may affect the whole societies are the main target for institutional design. Moreover, national and supra-national constitutions, legal codes and processes as well as innovative and wide-ranging strategic political-administrative programmes also occur at this level. The meso-level concerns planning and implementation structures and processes. This includes establishing and operating inter-organisational networks, creating new organisations and transforming existing ones. The meso-level also includes laws, regulations and resources to develop and implement policies, programmes, projects and plans, through which incentives and constraints may be devised and deployed. The lowest level involves intra-organisations, addressing organisational sub-units and small semi-formal or informal social units, processes and interactions, such as committees, teams, task forces and work groups.

Of this framework, the meso-level is associated most strongly with the planners' field of practice (Alexander, 2005). Coastal strategic planning, which can be conceptualized as a specific type of institution, also belongs to this level. This specific institution is the main subject we analysed. To examine the institutional implications for integrating ESs in coastal strategic plans, it is important to understand what current "rules, procedures and organisational structures" (Alexander, 2006) are for managing coastal behaviours or actions from three levels rather than focussing solely on the meso-level. Some agencies, legislative acts and regulations appeared in all four Jiaozhou Bay plans, which demonstrate attention and effort being accorded to coastal institutional practices by those in government and policymakers, albeit generally. The layered analysis framework of institution design here also included a focus on understanding contextual institutions (for coastal strategic planning), similar to established methods of institutional analysis (e.g. North, 1990; Crawford and Ostrom, 1995; Williamson, 2000; Hogan et al., 2011; Ostrom, 2011). During the analysis we found that the explicit emphasis in Alexander's framework on a coordination at the meso-level, particularly concerning planning and its nested institutions that are required to be carefully designed provided a better way for framing and interpreting the Jiaozhou Bay data to ascertain its institutional capacity. To have a more adequate understanding of institutions, we added to this framework some key elements like positon, boundary, aggregation and choices, particularly with regards to rules, mainly from Ostrom's institutional analysis methods (Ostrom, 2011). These additions are important because they, for instance, specify who is involved, what their roles are, and who decides for coastal strategic planning. Scientific articles, legal documents, annual reports, newspapers and websites were examined to gain an overview of the institutional context (e.g. SOA, 2001; Lau, 2005; SOFD, 2012; QOFB, 2012; Wu et al., 2012). The results of this contextual analysis for institutional practice are presented in Section 3.2. Finally, our institutional analysis was confirmed by emailing or telephoning the five key government departments which had been involved in these four Jiaozhou Bay strategic plans.

3. Results

3.1. ES inclusion in the Jiaozhou Bay strategic plans

Table 3 shows the result of the content analysis of four strategic documents by using the whole set of coding elements in Table 2. Table 3 presents summarized references to coastal ESs from the four strategic plans we studied, which suggests that diverse activities in strategic plans could be characterised according to their different way of using and impacting ESs. It is clear that the term ecosystem service was not mentioned explicitly. However, the analysis found all the ESs listed in Table 2, except for the supporting services of resilient ecosystems and soil formation. Furthermore, two other services were identified in the plans: urban ecological space and sea sports (see Table 3). The former service is a provisioning service referring to the ecological space for establishing urban ecology intervals. It also benefits urban planning in terms of dividing different developing groups/function zones, while forming

Table 3
Coastal ecosystem services presented in coastal strategic documents related to Jiaozhou Bay.

Category	Plan 1	Plan 2	Plan 3	Plan 4
	'Conservation and Development Around Jiaozhou Bay' Strategy	The development plan of Shandong Peninsula Blue Economic Zone	The Twelfth Five-year National Economic and Social Development Plans of Qingdao	The overall urban plan of Qingdao (2011–2020)
Provisioning				
- Fishery and seafood	N/A	- Overseas fishery, offshore fishing base - Seafood intensive processing - Fishery resource restoration - Standardized ecological farming pond - Fisheries seed construction project	- Aquatic fingerlings, deep-sea fishing, fish processing and recreational fisheries - Fishery ecological protection - Artificial reefs - Ponds transformation projects	- High-quality seed research - Deep-sea fishing industry - Cage culture, hanging culture and pond culture - Restricted pond areas - Proliferation and artificial reefs
- Energy production	- Restore and improve material and energy circulation - Solar, wind, tidal energy, biomass and other clean energy	- Marine energy technology innovation capability (low-cost algal oil refining) - Offshore oil, gas, submarine coal mines - Tidal and wave power generation projects	- Offshore wind, tidal power, wave power, currents, ocean energy power and key equipment	- Wind, biomass, solar and other renewable energy sources based on local conditions
- Biochemical and pharmaceutical use	- New materials, biomedicine and other high-tech industries	- Marine bio-industry: medicine, cosmetics, materials, mariculture seeds - Seawater chemical materials industry: desalination, polymer materials	- Biotech drugs, vaccines, chemical reagents and innovative Chinese medical remedies - High-yield seed clone technologies - Seaweed chemical products and health foods - Saline planning and resources use	- Strategic new industries: marine materials, environmental protection and biological technologies
- Transport and navigation	- Port layout adjustment for a cruise homeport pier - Cross-harbour tunnel and bridge	- Water-land, river-sea consolidating transport - A shipping centre of Northeast Asia - Port and waterway building	- Cruise home port - Channel extension - Road network: cross-harbour tunnel and bridge	- Road around the bay, bridge and high-speed lane - Maritime passenger transport to improve land-island transport
- Coastal space for industrial development and infrastructure	- Reserve space resources for construction land, sea, coastline - Port and manufacturing industry on west coast; new high-tech industry on northern coast - Tourist piers for hub plan	- Qingdao Port: large-scale specialized terminals - Offshore oil drilling platforms, breakwater, cross-sea bridge, tunnel, pipelines - Marine industrial base - Coastal special agriculture	- East coast: tourism, commerce, exhibition, financial, cultural and technological services - West: manufacturing, petrochemicals and electronics industry, port logistics and tourism - North: high-end and new emerging industries - An international deep-water port area, passenger travel centre and cruises - A new coastal city planning	- Provide production space to maximize economic value of shoreline - Logistics centre for Northeast Asia - High-tech zone in northern bay - Start the west coast economic area, bonded port and export processing area
- Residential and industrial water supply	N/A	- Encourage qualified residential and industrial enterprises to use desalination water and recycled water	- Desalination and recycled water projects - Incorporate desalination seawater into urban water network	- Industrialization of desalination technology construct desalination plants, increase average daily water supply
- Urban ecological space	- Water, farmland, mountains and roads form urban ecology intervals along bay area	N/A	N/A	- Ecological interval and group development - Green belt connecting to ecological function zones and three river ecosystem space
Regulating				
- Flood, storm prevention	N/A	- Coastal shelterbelt, revetment forest and woodland resources repair - Flood, tide facility and mitigation system	- Flood control facilities and capacity, river pollution governance - 54 sluice reinforcement project and seawalls	- Protection for storm surge prone areas - Construct shelter belts in coastal hilly area - Set flood control project fortification levels
- Seawater intrusion	N/A	- Source projects, groundwater replenishment, and estuary underground reservoir construction	N/A	N/A
- Algal blooms	N/A	- Monitoring and response system against red tide, green tide and other wildlife disasters	N/A	N/A
- Erosion and siltation control	N/A	- Island soil erosion prevention and control	- Green vegetation along coastline and river - Pollution load into sea reduction	N/A

- Water purification, waste treatment	- Wastewater treatment, reclaimed water utilization - Artificial wetlands	- Pollution control and ecological remediation	- Water storage dam, artificial wetlands, river ecological restoration	- Water source protection area and forest belt - Sewage treatment and recycling facilities - Eco-control of rivers
- Climate regulation	- Establish sound urban structure and layout pattern that conforms to natural processes	- Carbon sequestration function of algae, shellfish, etc. - Develop ocean carbon sink industry	N/A	N/A
Cultural				
- Tourism and recreation	- Wetland park for ecotourism - Tourism function exploitation around the bay	- Coastal agricultural tourism corridor - Tourism product quality and leisure facility improvement - Cruise routes based on water/ island tourism	- Holiday, marine, cruise, cultural, rural and speciality fishing village tourism, exhibition festivals and sports tourism	- Four tourism clusters characterized by European style architecture, sailing, cruises, island resorts, Clam Festival products, sports fishing and leisure
- Sea sport	N/A	- Sea sports facilities - Marine sports centre and industry base	- Sailing infrastructure and activities - High-level sporting events	- East Bay Coastal Zone develops yacht leisure and races
- Cognitive values	- Total pollution source control, annual total emissions reduction, water quality function standards - Dynamic monitoring and emergency response system	- Enhance the marine innovation platform - university and discipline construction, international cooperation - Information infrastructure - Marine climate meteorological research	- Strengthen offshore technology application - Research into basic marine science - Oil spills, red tides, enteromorpha, storm surges and sea ice forecasting systems - Environmentally-friendly technology and equipment - Information sharing systems	- Blue high-end R&D centre establishment - Education centres: a combination of science, education and training, promoting sea-related vocational institutions - Monitoring and forecasting system
- Aesthetic beauty	- Natural landscape: shoreline, wetlands and river headland - Human landscape design	N/A	N/A	- Protect landscape of mountain, sea, city, island, bay and river - Afforest mountain range
- Cultural heritage and identity	N/A	N/A	- International Beer Festival and Sailing Week - Historical sites, buildings and districts - Marine folk festivals and performing arts industry	- Strengthen the Olympic Sailing City brand - National marine cultural exchange platform - Urban purple line to protect heritage
Supporting				
- Maintenance of biodiversity	- Artificial measures to moderate the introduction of suitable species	- Rare and endangered species gene pool maintenance and ambulance operation, monitoring ambulance network, aquatic organism breeding	- Urban wetland park construction	- Delineation of wetland protection zones
- Maintenance of habitats	- Designate marine protected control line, non-reclamation area - Environmental capacity research - Ecological wetland planning	- Protected ocean and fishery areas - Marine ecological restoration governance: resource use compensation, typical ecosystem protection and restoration	- Delineate land reclamation and river control lines and the intergenic ecological region - Island and marine protected areas - Wetland Nature Reserve - Estuarine ecosystem restoration project	- Restore natural properties of aquiculture ponds and control pollution sources - Natural shoreline and bay-round wetland - Urban blue line to provide boundaries for river, reservoir and wetland protection
- Resilience	N/A	N/A	N/A	N/A
- Soil formation	N/A	N/A	N/A	N/A

a new landscape. The latter service concerns providing sports sailing, yacht races and other seawater competitions. This service was taken into consideration in strategic planning as a source of both cultural and economic benefits.

Table 4 provides a frequency overview of ESs as presented in the four coastal strategic planning documents. First, coastal space for industry and infrastructure (belonging to the provisioning category) was mentioned the most. Interestingly, this result accounts for about 13 percent of the all coded results. The emphasis of the coastal spatial resource utilization was on marine resource advantages. Their 'superior position' and 'powerful driving forces' were regarded as benefitting main industrial development. Second, the habitat maintenance service (under the supporting category) was included as often as the previous service. As shown in Table 3, the maintaining habitat service illustrated a close link with the increasingly serious coastal problems (e.g. shrinking sea area and water pollution) and protecting biodiversity. Third, cognitive value, a specific cultural service, accounted for around 12 percent of all coded results. Marine biological, chemical and energy technologies were presented as sources of substantial economic benefits in the strategic plans. The scientific research and technologies based on the marine resources thus demonstrated a tremendous advance. Fourth, mitigating marine disasters, monitoring disasters, meteorology and water quality were all promoted in the marine information strategy. The cultural service of tourism and recreation also had an important place in the strategic plans. Beach leisure is a traditional and famous urban symbol of Qingdao, forcing those in government to commit to planning wetland parks, speciality fishing village tourism and exhibition festivals (see Table 3). By contrast, the resilience of ecosystems and soil formation services were rarely mentioned. The most likely reason is the abstract quality of these services and the difficulty experienced in valuing them.

Table 4
Coastal ecosystem services presented in coastal strategic documents for Jiaozhou Bay.

Category	Plan 1	Plan 2	Plan 3	Plan 4	Sum	%
Four services sum					162	100
Provisioning					64	39.5
- Fishery and seafood	0	3	5	2	10	6.2
- Energy production	1	2	1	1	5	3.1
- Biochemical and pharmaceutical use	1	3	5	2	11	6.8
- Transport and navigation	2	2	3	2	9	5.6
- Coastal space for industrial development and infrastructure	4	6	6	5	21	13.0
- Space for urban ecological space	1	0	0	3	4	2.5
- Residential and industrial water supply	0	1	1	2	4	2.5
Regulating					20	12.3
- Flood, storm, tsunami & hurricane prevention	0	2	1	2	5	3.1
- Seawater intrusion	0	2	0	0	2	1.2
- Algal blooms	0	1	0	0	1	0.6
- Erosion and siltation control	0	1	1	0	2	1.2
- Water purification and waste treatment	1	2	3	2	8	4.9
- Climate regulation	1	1	0	0	2	1.2
Cultural					49	30.2
- Tourism and recreation	5	3	3	3	14	8.6
- Sea sports	0	1	2	1	4	2.5
- Cognitive values	1	7	6	6	20	12.3
- Aesthetic beauty	2	0	0	2	4	2.5
- Cultural heritage and identity	0	0	4	3	7	4.3
Supporting					29	17.9
- Maintenance of biodiversity	2	4	1	1	8	4.9
- Maintenance of habitats	3	4	5	9	21	13.0
- Ecosystem resilience	0	0	0	0	0	0.0
- Soil formation	0	0	0	0	0	0.0

Fig. 2 presents the percentages for each ES category. To sum up, the provisioning group was the most commonly mentioned (39.5%), followed by cultural, supporting and regulating services at 30.2%, 17.9% and 12.3%, respectively. This result is consistent with the general human social preference for provisioning services provided by different ecosystems (Foley et al., 2005). Nonetheless, the results show less prominence for the regulating services. Only three specific services belonging to this group were explicitly mentioned (see Table 3), namely flood regulation (coastal shelterbelt construction), climate regulation (carbon sequestration through exchange functions of algal and shellfish), and water purification and treatment (through artificial wetlands). Regulating measures were presented not so much as designs involving ecosystem functions and processes, but predominantly as employing artificial methods. For instance, many construction projects have been planned to mitigate storm surges in Jiaozhou Bay, such as breakwaters, underground reservoirs and dams.

Applying our method, ESs can be clearly identified in coastal strategic planning. The whole range of possible services in planning can thereby be detected, including those previously neglected. Rodríguez et al. (2006) report that a heavy emphasis on provisioning ESs could be a consequence of their value, being more tangible and identifiable by societies, whereas the economic values of other ESs are more difficult to quantify. For instance, it has previously been difficult to value the supporting services of resilient ecosystems and soil formation investigated in this research. However, the other ESs might be more critical for the whole system than the provisioning ESs. The regulating services, which have the function of maintenance and enhancement, could be associated with the capacity of socio-ecological systems to cope with or adapt to the disturbances of various kinds which accelerate human and ecological changes (Carpenter et al., 2006; Bennett et al., 2009). In coastal strategic plans, actions and plans that act on the regulating services are needed to improve the future ability of socio-ecological systems to be sustained against shocks.

The levels of attention paid to the various ESs discussed here were obviously influenced by the current formal institutions they were a part of. Some ESs identified in the four strategic plans were associated with several general regulatory and financial mechanisms, illustrating links between ESs and institutions. To make this clearer, we will develop insights into the integrated implication for ES use from three levels in the following section.

3.2. Existing institutions for integrating ESs into the selected strategic plans

3.2.1. The macro-level

Sustainable development in China is a fundamental national strategy (Wu et al., 2012). Since the 1990s, China's Ocean Agenda 21 (1996), the Marine Development Programs (1998), the National Marine Economy Development Plan (2003) and the National

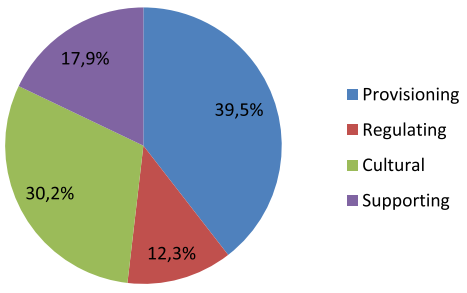

Fig. 2. ES category frequency.

Marine Development Plan (2008) have proposed background, objectives and tasks for sustainable marine development. In 2011, China's Policies and Actions for Addressing Climate Change (2011) were developed with a focus on using marine clean energy, marine climate monitoring and ecological restoration in coastal areas. All these national directives encourage both the adjustment of the marine economy and more efforts to be invested into marine environmental protection (see Table 5). As an important coastal province, in 2009, a national-level proposal for the Shandong Peninsula Blue Economic Zone (Qingdao took a leading role in this region) was promoted to enhance the regional economy, its science, resource utilization and culture. In provincial and coastal municipal strategic plans, marine economic structures were first adjusted and optimized, from a narrow focus on fisheries and salt production into a comprehensive system. In 2011, fisheries, coastal tourism, ocean chemical production, marine transportation and engineering construction dominated, accounting for around 80 percent of value added by Shandong's marine industry (SSB, 2011), greatly enhancing the provisioning and cultural services. Meanwhile, traditional raw material industries were not supported, but energy-saving hi-tech industries were encouraged. For instance, a Northern Jiaozhou Bay Hi-tech Zone was promoted in Plan 1, focussing on marine biochemical and pharmaceutical research, the utilization of solar energy, wind energy, marine bioenergy and other hi-tech technology eligible for general tax benefits. Consequently, the provisioning services and cognitive values ecosystem services increased.

Marine environmental protection also attracted extensive attention and was supported by some sectoral laws. In particular, the Law of Sea Area Use Management was enacted to coordinate conflicts between economic development and environmental protection, by promoting a unique form of marine spatial planning, namely Marine Functional Zoning (MFZ). This law stipulates that any sea use must comply with the MFZ scheme established by the State (SOA, 2001). In the recent Shandong provincial MFZ (approved by the State), the main functional zones of Jiaozhou Bay were designated for shipping, tourism, and the fishing and salt industries (SOFD, 2012), creating legal priorities for developing these specific provisioning services on the basis of local ecosystem patterns and functions. In addition, the supporting services of habitat/biodiversity maintenance could be highlighted by the Jiaozhou Bay wetlands protection initiative as well as the constraints placed on reclamation activities along the Bay (e.g. forbidden land recovery for certain areas, compensation and a fine for illegal changes to marine features).

3.2.2. The meso-level

Vertical and horizontal power and institutional structures coexist in China (Lieberthal, 1997). As a result, the unified coastal ecosystem for management is artificially divided. With regard to the vertical institutional structure relevant for coastal strategic planning related to Jiaozhou Bay, Fig. 3 presents a hierarchy of sectors or departments with similar functional natures, ranging from central to local government (Wu and Sun, 2011). Specifically, the State Council has a department named the State Oceanic Administration (SOA), which is the leading agency responsible for China's ocean policymaking and overall management of ocean and coastal affairs (Cao and Wong, 2007). An SOA branch for the North

Table 5
Likely implications for ESs of existing institutions of strategic planning for Jiaozhou Bay.

Level	Institutions		Implications for ESs*
Macro-level	Marine sustainable development	Marine Economy • Multi-industries • Hi-tech industries Marine Environmental Protection • Policies and actions for addressing climate change • Marine Functional Zoning • Ecological restoration in coastal areas, wetlands protection, reclamation constraints	Encourage: Provisioning (fisheries, biochemical use, transportation, land for engineering construction and marine clean energy production) Encourage: Cultural (tourism, sea spot, cognitive values) Encourage: Provisioning (fisheries, transport and navigation and salt production) Encourage: Cultural (marine climate monitoring and tourism) Encourage: Supporting (maintenance of habitats and biodiversity) Encourage: Regulating (prevention of flood, storm surge and seawater intrusion)
Meso-level	Vertical structure Horizontal structure	• Vertical structure: State Council – State Oceanic Administration – SOA branch for the North China Sea – Shandong Oceanic and Fishery Department – Qingdao Ocean and Fishery Bureau • Horizontal structure: State Council – Shandong government – Qingdao municipal government – Local government (along with the relevant sectors of each government) • Unbalanced power • Overlapping jurisdiction	Encourage: Provisioning (services create economic benefits) Encourage: Cultural (services create economic benefits) Weaken: Regulating (regulation of climate change, sea-level rise and seawater intrusion) Weaken: Supporting (Maintenance of habitats and biodiversity)
Micro-level	Operation committees/offices Assessment institutions Advisory committees	• Partial professional assistance • Technological constraints on ES evaluation • The absence of strategic assessments	Encourage: Provisioning (fisheries and other tradable living resources) Weaken: Cultural (landscape and education) Weaken: Regulating and Supporting (habitats and biodiversity reserves)
	Public participation	• Large businesses economic benefits emphasis • Limited reflection of social value of ESs by small entrepreneurs	Encourage: Provisioning and Cultural (services create economic benefits) Weaken: Regulating and Supporting (services work as maintenance and enhancement)

* 'Encourage' implies an institution with regards to strong incentives, legislation, permits, rewards, subsidies, information (monitoring information, professional knowledge, social value) or assessments that may stimulate or protect particular ESs. 'Weaken' implies institutions with less of these institutional arrangements, or with factors ignoring or even damaging particular ESs.

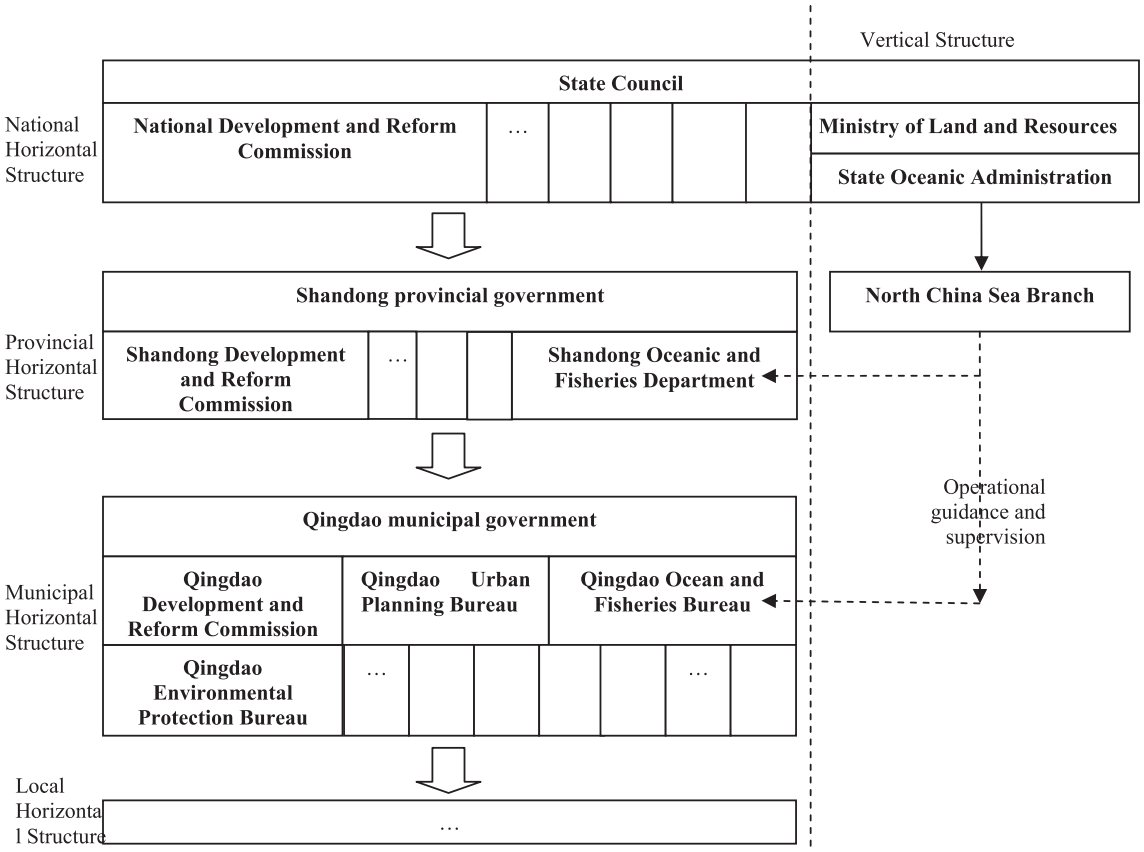

Fig. 3. The meso-level: Vertical and horizontal institutional structures relevant to strategic planning in Jiaozhou Bay.

China Sea has been established in Shandong. SOA and its North China Sea branch offer operational guidance and supervision to the lower-level marine departments (e.g. Shandong Oceanic and Fisheries Department, Qingdao Ocean and Fisheries Bureau). One guidance and supervision practice involves directing the regulating and supporting services, for example, the control of pollutants discharged into sea, the regulation of climate change and sea-level rise, and marine ecological damage management. However, in comparison with other government bodies, SOA and its branches have more interest in ES protection, but less power over lower-level marine departments. There are direct and strict administrative relationships between government bodies and the lower-level departments. The result of this power issue is a limitation of the extent to which SOA and its branches can discharge their functions in introducing and implementing regulating or supporting services in the four selected plans. Similar problems also exist in different but relevant state-level departments (for instance, the Ministry of Environmental Protection), for efficiently encouraging, regulating or supporting ESs in local areas.

The horizontal institutional structure relevant for coastal strategic planning related to Jiaozhou Bay (see also Fig. 3) consists of government bodies (from the national to the local level) and their functional sectors (Wu and Sun, 2011). Due to the high spatial heterogeneity (coastal land, intertidal area and aquatic systems) in coastal areas (Cao and Wong, 2007) and the various jurisdictions provided by the differing sectoral legislative orders, power has been diffused to many different departments (e.g. marine, environmental protection, agriculture, forestry and land resources). During the development process of the selected strategic plans, this imbalance of power among the relevant sectors, and particularly also the initial market-oriented preferences of the responsible planning coordinator, have resulted in only a partial consideration of ESs. It is therefore necessary to create platforms involving the sectors engaged in coastal strategies, for knowledge sharing and cooperative planning about integrated coastal strategies based on ESs management.

The coordinating body of the four selected plans was either the Development and Reform Commission (DRC) or the Urban Planning Bureau (UPB). These agencies have played "a privileged role with an authority to accord scientific knowledge" (Waylen and Young, 2014) over other sectors in planning. These two bodies emphasise economic or social benefits and spatial planning (e.g. establishing urban ecology intervals and arranging coastal industrial space), respectively. As a consequence, both authorities emphasised the provisioning and cultural services over the ESs without obvious economic values (such as the regulating and supporting services). In addition, the jurisdictions of the many different departments falling under a given government body frequently overlapped or were unclear. These departments pursued single-sector interests with regards to market, social or ecological benefits, performance targets and more administrative rights, which hampered inter-organisational interaction and the efficiency of planning processes. This especially is the case for cross-sector, cross-boundary or cross-time issues such as the question how to guarantee habitat conservation under developing pressures of upstream areas, and how to define an acceptable ecosystem level for dredging, filling and other activities allowed with respect to their long-term cumulative effects. These kinds of mismatches between the current institutional structure and the coastal resources for governance could have resulted in multiple ES utilization conflicts. These conflicts were exacerbated by inconsistent ES monitoring of the information held by the array of departments engaged in managing

ESs. The varying monitoring information could have resulted in different or even conflicting considerations of the same coastal ESs (particularly the regulating and supporting services) among the involved departments. This inconsistency could obstruct sectoral bodies from stressing the importance of the regulating or supporting services in strategic plans. Another barrier to better understanding the information by diverse sectoral bodies could be methodological difficulties in mapping or measuring values of ESs. Overall, coastal functions and ecosystem services were divided among different departments, possibly causing the ineffective exploitation of the ESs as well as the application of the concept in coastal strategic planning.

3.2.3. The micro-level

This level concerns operation committees/offices, assessment institutions, advisory committees and public participation (see Table 5). To smoothly implement each of the strategic plans for Jiaozhou Bay, a leading operation committee/office was established under the main coordinating sectoral body, such as the DRC and UPB. The responsible sector organized and supported the advisory committees and assessment institutions authorized by the government to conduct field investigations and environmental assessments for the four strategic plans. Public participation was required during the course of these investigations and assessments, following certain laws and regulations. However, these micro-level institutional arrangements also exerted different effects on the ESs.

First, coastal strategic planning related to Jiaozhou Bay required expert scientific knowledge and experience from an array of marine disciplines. Although experts from the fields of marine resource development and environmental protection were included, their advice mainly concerned the provisioning services, such as enhancing biological, energy or seawater resource use and port economy (SPBEZCO, 2013). The absence of professional assistance on how to employ the cultural, regulating and supporting services could have undermined the inclusion of these services in the four strategic plans.

In addition, according to current law and regulations, the assessment institutions authorized by the government are responsible for Marine Environmental Impact Assessment, Sea Area Use Demonstration and Marine Ecological Damage Compensation for all kinds of marine projects before being approved by the local governments in subsequent specific plans. When carrying out these assessments, technological constraints regarding evaluating the less tangible and identifiable ESs (some of the cultural, and the regulating and supporting services) could result in the less successful implementation of a broad range of ESs. For example, tradable living marine resources (mainly belonging to the provisioning service) are the main basis for calculating the damage caused by planned marine economic activities (QOFB, 2012). In contrast, damage assessments of the natural landscape, tourism and nature reserves depend solely on expert groups, which could fail to reflect 'true' value of coastal and marine ESs due to subjective factors (QOFB, 2012). In addition, the lack of Strategic Environmental Assessment (SEA) normative guidelines deters the assessment institutions from employing SEA, which is a potential method for including ESs in spatial planning (Geneletti, 2011).

Third and finally, in China politicians tend to focus on large businesses rather than small entrepreneurs, such as individual fishermen who actively use certain ES, and who, as a consequence, are not explicitly considered as important stakeholders (Lau, 2005). Indeed, this phenomenon is also due to a lack of environmental awareness among the general public. As a result, large businesses are able to exploit high-value market services, while local communities merely act as supporters in terms of providing advice and collecting data for the executive institutions (Wu et al., 2012), specifically offering the varying social values attached to the regulating and supporting services such as the prevention of seawater intrusion, soil conservation and other functional services. Then the important local knowledge of systems' functioning and monitoring could be missed (Gelcich et al., 2006).

4. Reflection and discussion

4.1. Institutional strengths and weaknesses of strategic planning in Jiaozhou Bay

Based on the empirical analysis of Jiaozhou Bay, we can conclude that the four coastal strategic plans that we studied were strongly influenced by their institutional context from three levels, which further impacts on the levels of inclusion of the four categories of ES. Together, the results demonstrate two institutional strengths that yield benefits to integrating coastal ESs into strategic planning. At the same time, the selected strategic plans face four main weaknesses that could create obstacles for their institutional capacity of ES governance (see Table 6).

Most of these strategic plans emphasise the adjustment and optimalisation of marine economic structures because of the political aim to achieve sustainable development and address climate change. This is the first institutional strength essentially responsible for encouraging a wide range of ESs due to a great increase in the varieties of marine industries that can employ the various coastal ESs, and of the energy-saving hi-tech industries. The second strength is the strong initiatives for marine environmental protection in the Jiaozhou Bay area (in particular wetlands and biodiversity protection), which directly enhance the supporting service and thereby assist the proper delivery of the other services.

However, the current formal institutional design of the coastal strategic plans relevant to Jiaozhou Bay also has four important weaknesses. The first is the dominant initiative of economic benefit, particularly related to the provisioning services from the macro to the micro institutional design level (see Fig. 2 and the last column of Table 5). Their indirect and tangible market values can meet the demands of major governance bodies. Other ESs are unable to receive the same amount of attention as the provisioning services. Rational consideration and employment of the regulating services provided by the ecosystem, in particular, has been ignored (see Table 5). Unfortunately, the strategic plans in Jiaozhou Bay therefore do not employ the whole range of ESs.

The fragmented institutional management of coastal ESs (i.e. the co-existing vertical and horizontal structures discussed for the meso-level) is a second weakness. There is no unified and effective coordination mechanism for the strategic plans in Jiaozhou Bay. As a result, it is difficult to share information, collect opinions and clarify jurisdictions among the multitude of independent departments and subsections which continuously pursue individual

Table 6
Institutional strengths and weaknesses of strategic planning in Jiaozhou Bay.

Institutional strengths	1. Adjustment of the structure of the marine economy 2. Increasing awareness of marine environmental protection
Institutional weaknesses	1. Dominant market-oriented interest 2. The fragmented institutional structure for managing ESs 3. Limited specialist and technological capability for ESs assessment 4. Decision-making lacks integrated reflection of the social value of ESs to the public

interests from the ESs. The current unbalanced division of power, inconsistent distribution of information and methodological difficulties have prevented the key marine and coastal departments from implementing the commonly ignored regulating service.

The third institutional weakness could be interpreted from the micro-level analysis, which concerns the limited specialist and technological capabilities for ES assessment. In effect, the current assessment methods prescribed in laws and regulations lack insight into the 'true' value of ESs. Mainstream project-based assessment is unable to offer an overview of ESs consideration in coastal strategic planning. Limited time and payoff mechanism may also restrict experts' evaluation work of complex ESs. This weakness is also caused by the lack of an integrated reflection of the social value of ESs to the public in decision-making processes, which is the fourth and final weakness that we identified based on the micro-level analysis. The current institutional framework for coastal strategic planning does not enable local residents to participate in the whole process of planning and decision-making (Wu et al., 2012). More specifically, the four strategic plans for Jiaozhou Bay do not cover a wide range of public participation channels (such as Voluntary Environmental Agreements or Coastal Forums), but narrow and isolated ones, including only partially affected stakeholders. The poor involvement of the general public, then, must hinder the explicit reorganisation of the social values attached to different ESs, as well as the related conflicts in planning.

4.2. International comparative position

The formal institutional implications for ESs of this study are similar to other international case studies that focus on diverse ecosystems under different institutional contexts (see Table 7).

Currently, at the macro-level, international agreements and national legislations have become increasingly dominant drivers in managing the relationships between human and nature (e.g. the United Nations Framework Convention on Climate Change, the World Summit for Sustainable Development and the Convention on Biological Diversity, the EU Habitats Directive and Birds Directive, and EU Water Framework Directive). However, few explicit protection arrangements for ESs have been adopted either in those international agreements or domestic law. The main reason could be that the legal protection of the whole set of ESs was not a primary objective when these international agreements and national constitutions were established (Ekstrom and Young, 2009; Cinner et al., 2012; Pittock et al., 2012; Primmer and Furman, 2012). Rather, most of the conservation agreements aim at protecting specific ecological components, for instance, species, habitats and water, and managing the effects of human activity on ecosystems. Accordingly, such constitutions "indirectly protect some important ecosystem processes and benefits by chance rather than by design" (Ekstrom and Young, 2009). However, what is distinctive about the ES concept integrated at the constitutional level is the legal basis provided for compensation or mitigation in terms of ES valuation (Ruhl and Gregg, 2001; Evans and Klinger, 2008; Söderman and Saarela, 2010). Besides, the ecosystem approach is suggested in some countries' coastal and marine policy, such as the European Common Fisheries Policy (Kalikoski et al., 2002), the UK Marine and Coastal Access Act (Ekstrom and Young, 2009) and the US Marine Planning Handbook (Evans and Klinger, 2008), but only in a general sense.

At the meso-level, the misfit between geographic scales and institutional scales is a significant challenge for many countries to manage ESs. Institutions should "vary in both hierarchy and scale to accommodate the issues and the instruments selected to address them" (Hogan et al., 2009). Some international and national constitutions have changed the geographical scales and have influenced protection measures for certain ESs (Kalikoski et al., 2002; Österblom et al., 2010). However, the traditional institutional structures for ES governance cannot fully meet the obligations under the range of international and national agreements. There is an increasing world-wide criticism on the institutions, which has both horizontal and vertical aspects, such as overlapping mandates, unclear linkages between multi-level governance, and a lack of collaboration among stakeholders (Salzman et al., 2001; Kalikoski et al., 2002; Goldman et al., 2007; Hanna, 2008; Ekstrom and Young, 2009; Holt et al., 2011; Cinner et al., 2012; Namaalwa et al., 2013). Accordingly, many initiatives on constructing a platform have been undertaken for knowledge exchange, learning, and negotiating on political priorities among key stakeholders (Kalikoski et al., 2002; Hanna, 2008; Ekstrom and Young, 2009; Söderman and Saarela, 2010; Maynard et al., 2011; Cinner et al., 2012; Sutton-Grier et al., 2014). Thus, new organisations, authorities and bottom-up approaches have been put forward in the U.S. (Primmer and Furman, 2012), Australia (Maynard et al., 2011; Österblom et al., 2010), Brazil (Hanna, 2008) and other countries. However, broadening the scope of management may result in higher information- and negotiation-related transaction costs (Goldman et al., 2007), which may overwhelm the willingness and ability of community-based efforts (Hogan et al., 2009). The international cases also suggest some financial initiative-oriented mechanisms (e.g. carbon market and wetland banking) have been operated for key individual services but not a bundle of ESs. This shortage could lead to new externalities and influence different

Table 7
Generalizations for three-level institutions on ES integration from international case studies.

Institutional levels	Generalizations	References
Constitution writing	Increasing international agreements and national-level legislations about conservation Few explicit guidelines for ES protections Focus on protecting specific ecological components Legal basis for compensation or mitigation by valuing ESs	(Ruhl and Gregg, 2001; Evans and Klinger, 2008; Ekstrom and Young, 2009; Söderman and Saarela, 2010; Cinner et al., 2012; Pittock et al., 2012; Primmer and Furman, 2012).
Inter-organisational coordination	Misfit between geographic scales and institutional scales Lack of horizontal and vertical cooperation Establish a platform for learning, negotiation, decision making, monitoring and assessment High transaction cost Financial incentive mechanism for managing individual ES provision	(Salzman et al., 2001; Kalikoski et al., 2002; Goldman et al., 2007; Hanna, 2008; Ekstrom and Young, 2009; Österblom et al., 2010; Söderman and Saarela, 2010; Holt et al., 2011; Maynard et al., 2011; Cinner et al., 2012; Primmer and Furman, 2012; Namaalwa et al., 2013; Piwowarczyk et al., 2013; Sutton-Grier et al., 2014).
Intra-organisational institution	Low ES awareness of the public Different levels of stakeholders' importance and influence Lack financial security for ES protections and monitoring Little requirement and encouragement for explicit use of ES economic and social value	(Salzman et al., 2001; Kalikoski et al., 2002; Hanna, 2008; Ruckelshaus et al., 2008; Lebel and Daniel, 2009; Österblom et al., 2010; Söderman and Saarela, 2010; Maynard et al., 2011; Piwowarczyk et al., 2013; Potts et al., 2014).

stakeholders' benefit and cost (Cinner et al., 2012).

A broad group of stakeholders should be involved in the micro-level institution because of the interests that closely link with diverse ESs across scales. The reason why public participation particularly in ES analysis is limited is twofold: a low ES awareness of the public and different levels of their importance and influence (Salzman et al., 2001; Hanna, 2008; Lebel and Daniel, 2009; Piwowarczyk et al., 2013). Even in some cases resource users are involved in the planning, the authority still emphasise public education and public assessment as key strategic areas (Ruckelshaus et al., 2008; Österblom et al., 2010). As a key stakeholder, the role of the scientific community in creating collaborative learning platforms has been highlighted since scientists could address some areas of limited data availability and facilitate routines of assessment and stakeholder dialogues (Kalikoski et al., 2002; Maynard et al., 2011). Consultancy agencies in different cases merely have a supporting and guiding role in terms of environmental assessment and studies. Most of the consultancy agencies are incapable of capturing the whole sets of ESs under anthropogenic influences (Kalikoski et al., 2002). Additionally, a lack of financial security for environmental protections and monitoring is also a critical barrier for considering more ESs in operation (Söderman and Saarela, 2010; Piwowarczyk et al., 2013). Although several mechanisms for certain ES have been provided, there is no explicit use of ES economic and social value at the assessment and planning stages due to little requirement and encouragement for such approaches by regulatory bodies (Söderman and Saarela, 2010; Potts et al., 2014).

Consequently, many similarities come to light between our results and the international case studies. These similarities mainly include an increasing awareness of conservation in international and national constitutions, an inter-organisational fragmentation that results in scale misfits and high transaction cost, poor ES awareness of the public, different importance and influence of stakeholders, and a limited use of ES assessment in operation. However, some differences can also be found. One obvious difference is the extensive market-oriented interest at all three institutional levels for Chinese coastal strategic planning. To a large extent, due to urgent developing demands during the current Chinese social and economic stage, the conservation of non-profit ESs largely depends on the question how successful the institutions are in restraining economic interests and priorities at all levels of institutional design. The emphasis on the ecosystem approach in Chinese coastal and marine policies is not as strong as in some more developed countries' political discourse. Moreover, as a case characterised by hybrid horizontal and vertical institutional structures, our findings suggest a need to clarify responsibilities, ensure a balanced distribution of power, and establish innovative authorities that could be essential for addressing the mismatches between institutional structures and coastal resources. Meanwhile, drawing lessons from other cases with new-scale authorities and bottom-up approaches, it should be noticed that there is still a place for government and sectoral bodies at different administrative levels to play their classic roles. In other words, not only a new coordinating role for government (e.g. encouraging knowledge learning, negotiation and ES market establishment) should be performed, as many case studies highlighted, but also exclusive responsibilities should be in place. Where governments still hold a relatively dominant position in institutional structures, as in China, their substantially regulative influence could extend to, for instance, financing long-term ES monitoring, data base establishment and quantified technique studies, framing information sharing institutions among sectors, drawing up ES-oriented planning and assessment guidelines, and guaranteeing law enforcement.

5. Conclusion

This paper attempts to link perspectives from both ecosystem-service thinking and strategic planning institutions. The content analysis method is a promising approach for empirical work to show "how dialogue, understanding, preferences and policy commitment evolve" with respect to using ESs (McKenzie et al., 2014). However, there are general lower awareness of policymakers in China on the capacities of fully integrating the concept of ESs in a structured way. The concept of ES has not been aware of by policymakers in many areas including China. The content analysis of planning formal documents in this paper, together with other similar studies (e.g. Hauck et al., 2013; Wilkinson et al., 2013) reveal that policymakers have already unconsciously taken diverse ESs into account. Uncovering these implicit consideration and their ways of doing so may improve policymakers' acceptance and understanding of ES concept, which could precede more specific actions of integrating ESs, for instance, employing methods of ES mapping and valuation. Second, such analyses may facilitate policymakers to realise how complex our social-ecological system is and how critically strategic planning relies on ESs, which requires for a more integrated and adaptive perspective to deal with the complexity. Third, this paper clarified different extents to ES inclusion, and produced similar findings to other cases, i.e., that provisioning services and cultural services are more widely discussed than regulating and supporting services (e.g. Hauck et al., 2013). This result reminds policymakers of a serious knowledge gap for regulating and supporting services. It demonstrates the need for institutional capacity building in strategic planning, particularly with regards to regulating and supporting services. Further efforts, therefore, should be invested in enhancing capacities for addressing and understanding long-term, slow changes of coastal ecological attributes. Additional capacity building efforts should consider making real-time strategy adjustments, and integrating scattered information concerning indirect impacts on diverse ESs. To address priority issues or values concerning externalities, it also requires to build capacity of quantifying and conveying regulating and supporting services by, for instance, establishing unified standards based on both market and non-market ES valuation to serve as institutional instruments. The results also inform us where more funding should be allocated for future research to guarantee a sustainable use of key ESs in local areas.

More importantly, according to the multi-level institutional framework for assessing the ES-managing capacity of existing institutions, this research provides an understanding of formal institutional factors and the way they may offer capacity of integrating ESs into coastal strategic planning. Our findings demonstrate the majority of the general implications of formal institutions on ES integration, which are carried by a range of international empirical studies. The international comparison analysis suggests that considerable influences of extensive market-oriented incentives and governments' exclusive responsibilities on ES incorporation seem to be more distinctive for Chinese coastal strategic planning. However, it is a quite challenging task to further attune institutional design with the local resource pattern and integrate ES into different institutions including strategic planning. Accordingly, efforts to address the barriers and challenges discussed above could be beneficial to realising this goal.

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